What is claimed is:

1. In a cell stack of a proton exchange fuel cell, said cell stack composed by laminating a plurality of unit cells and a plurality of separators, each of said unit cells composed of an anode electrode, a cathode electrode and a solid polymer electrolytic membrane arranged between said anode and cathode electrodes, each of said separators arranged between said unit cells, respectively, said separator of said proton exchange fuel cell, comprising:

a separator substrate; and

a multi-coating layer formed on said separator substrate;

said multi-coating layer including at least two layers of a low electric resistance layer, a corrosion resistance layer and a peeling resistance layer.

2. The separator of a proton exchange fuel cell according to claim 1, wherein:

said multi-coating layer includes said peeling resistance layer provided on said separator substrate, said corrosion resistance layer provided on said peeling resistance layer, and said low electric resistance layer provided on said corrosion resistance layer.

3. The separator of a proton exchange fuel cell

according to claim 1, wherein:

said multi-coating layer includes a peeling resistance and corrosion resistance layer made as one layer by combining said peeling resistance layer and said corrosion resistance layer provided on said separator substrate, and said low electric resistance layer provided on said peeling resistance and corrosion resistance layer.

4. The separator of a proton exchange fuel cell according to claim 1, wherein:

said separator substrate includes one kind or a composite material of two or more kinds of stainless steel, copper and its alloy, aluminum and its alloy, and titanium and its alloy.

5. The separator of a proton exchange fuel cell according to claim 4, wherein:

said multi-coating layer includes one kind or a composite material of two or more kinds of materials having low contact resistance of Ni, Fe, Co, B, Pb, Cr, Cu, Ti, Bi, Sn, W, P, Mo, Ag, Pt, Au, TiC, NbC, TiCN, TiN, CrN, TiB_2, ZrB_2, Fe_2B, and Si_3N_4.

6. In a cell stack of a proton exchange fuel cell, said cell stack composed by laminating a plurality of unit cells and a plurality of separators, each of said unit cells

composed of an anode electrode, a cathode electrode and a solid polymer electrolytic membrane arranged between said anode and cathode electrodes, each of said separators arranged between said unit cells, respectively, said separator of said proton exchange fuel cell including a separator substrate and a multi-coating layer formed on said separator substrate, and said multi-coating layer including at least two layers of a low electric resistance layer, a corrosion resistance layer and a peeling resistance layer, a method of manufacturing said separator of said proton exchange fuel cell, comprising the steps of:

preparing said separator substrate; and

forming said multi-coating layer on said separator substrate by one kind or a composite process of two or more kinds of processes capable of forming a thin film of physical evaporation process, chemical evaporation process, nitride treating process, boride treating process, carbonizing process, plating process and spraying process.

7. The method of manufacturing said separator of said proton exchange fuel cell according to claim 6, wherein said step of forming said multi-coating layer includes the steps of:

forming said peeling resistance layer on said separator substrate;

forming said corrosion resistance layer on said peeling

resistance layer; and

forming said low electric resistance layer on said corrosion resistance layer.

8. The method of manufacturing said separator of said proton exchange fuel cell according to claim 7, wherein in said step of forming said multi-coating layer:

said multi-coating layer is formed using said plating process such that a film thickness of said low electric resistance layer is made at 0.02 μm or more, that of said corrosion resistance layer is made at 0.1 μm or more, and that of said peeling resistance layer is made at 0.1 μm or more.

9. The method of manufacturing said separator of said proton exchange fuel cell according to claim 7, wherein in said step of forming said multi-coating layer:

said multi-coating layer is formed using said physical evaporation plating process such that a film thickness of said low electric resistance layer is made at 1.0 μm or more, that of said corrosion resistance layer is made at 1.0 μm or more, and that of said peeling resistance layer is made at 1.0 μm or more.

10. The method of manufacturing said separator of said proton exchange fuel cell according to claim 9:

wherein crystal orientation of each layer composing said multi-coating layer is oriented to a direction of Miller index (200) or (002).

11. The method of manufacturing said separator of said proton exchange fuel cell according to claim 9:

wherein porosity in said multi-coating layer is made at $5 \times 10^{0}\%$ or less in terms of defective area rate.

12. The method of manufacturing said separator of said proton exchange fuel cell according to claim 6:

wherein material for said multi-coating layer formed on said separator substrate includes one kind or a composite alloy material of two or more kinds of materials having a lower electric resistance than that of said separator substrate of metallic material, ceramics material and cermet material.

13. The method of manufacturing said separator of said proton exchange fuel cell according to claim 6, further comprising a step of:

removing passive state film or oxide existing on said separator substrate electrically, mechanically or chemically before said step of forming said multi-coating layer.

14. In a cell stack of a proton exchange fuel cell,

said cell stack composed by laminating a plurality of unit cells and a plurality of separators, each of said unit cells composed of an anode electrode, a cathode electrode and a solid polymer electrolytic membrane arranged between said anode and cathode electrodes, each of said separators arranged between said unit cells, respectively, said separator of said proton exchange fuel cell including a separator substrate and a multi-coating layer formed on said separator substrate, and said multi-coating layer including at least two layers of a low electric resistance layer, a corrosion resistance layer and a peeling resistance layer, a method of manufacturing said separator of said proton exchange fuel cell, comprising the steps of:

preparing said separator substrate;

forming said multi-coating layer on said separator substrate by one kind or a composite process of two or more kinds of processes capable of forming a thin film of physical evaporation process, chemical evaporation process, nitride treating process, boride treating process, carbonizing process, plating process and spraying process;

removing said multi-coating layer electrically, mechanically or chemically, so that said multi-coating layer and said separator substrate are individually recovered; and

reusing material of said recovered multi-coating layer in manufacturing said separator of said proton exchange fuel cell.

15. The method of manufacturing said separator of said proton exchange fuel cell according to claim 14, further comprising the step of:

after recovering said separator substrate, pulverizing and resolving said recovered separator substrate electrically, mechanically or chemically; and

reusing material of said recovered separator substrate in manufacturing said separator of said proton exchange fuel cell.

16. The separator of a proton exchange fuel cell according to one of claims 6 - 15, wherein:

said separator is manufactured by using said method of manufacturing said separator of said proton exchange fuel cell according to one of claims 6 - 15.